

MATH APPLICATION ACTIVITY: CALCULATING GLOBAL CO₂ EMISSIONS

Carbon dioxide (CO₂) is the chief greenhouse gas resulting from human activities and causes global warming and climate change. There is no single indicator as complete and current as the monthly updates for atmospheric CO₂ from the Mauna Loa Observatory, Hawaii to help scientists know if enough is being done to solve these global problems

During the last 800,000 years, CO₂ fluctuated between about 180 ppm during ice ages and 280 ppm during interglacial warm periods. Before the Industrial Revolution in the 19th century, global average CO₂ was about 280 ppm. Today's rate of increase is more than 100 times faster than the increase that occurred at the end of the last ice age. The latest information on CO₂ concentrations in the atmosphere shows that this trend is continuing. The upper safety limit for atmospheric CO₂ is 350 parts per million (ppm), however, atmospheric CO₂ levels have stayed higher than 350 ppm since early 1988. The 2015 average annual concentration of CO₂ in the atmosphere (Mauna Loa Observatory) was 397.08 parts per million (ppm). The 2014 average was 394.93 ppm.

The major man-made sources of CO₂ are the industrial processes that generate power using CO₂-burning fossil fuels (oil, gas, coal) and the production of cement. At the same time, these activities are also the greatest opportunity for reductions of emissions to the atmosphere. Major industrial, and large, developing countries such as China and India rank high on the international list of countries with the highest CO₂ emissions. On a *per capita* (per person) basis, however, China and India rank very low. In 2014, the world's total emissions were over 40 billion metric tons of carbon dioxide per year. The world's population is now over 7 billion and climbing. Therefore, each person on the planet adds the equivalent of more than 5 metric tons of carbon dioxide to the atmosphere each year. Climate scientists say we have years, not decades, to stabilize CO₂ and other greenhouse gases before the warming trend will be irreversible.

Student Sheet 2

DATA TABLE: GLOBAL CO₂ EMISSIONS 2015

COUNTRY	RANK	TOTAL CO ₂ EMISSIONS	POPULATION 2015	PER CAPITA CO ₂
Romania		78745	19.94 M	
Austria		66897	8.5 M	
Portugal		52361	10.47 M	
Netherlands		182078	16.88 M	
Venezuela		201747	30.6M	
Germany		745384	80.78 M	
Italy		406307	60.78M	
Hungary		50583	9.87M	
UAR		167597	9.57M	
Iran		571612	78.0 M	
Argentina		180512	43.1M	
China		8286892	1.367B	
Thailand		295282	64.78M	
Russian Fed.		1740776	146.3 M	
Spain		269675	46.5 M	
Libya		59035	6.3M	
India		2008823	1.265 B	
France		361273	66.1 M	
Belgium		108947	11.23M	
Australia		373081	23.7M	
United Kingdom		493505	64.1M	
Mexico		443674	121.0M	
Rep.of Korea		567567	25.15 M	
Turkey		298002	76.66 M	
Croatia		20884	4.2M	
New Zealand		31551	4.5M	

Student Sheet 3

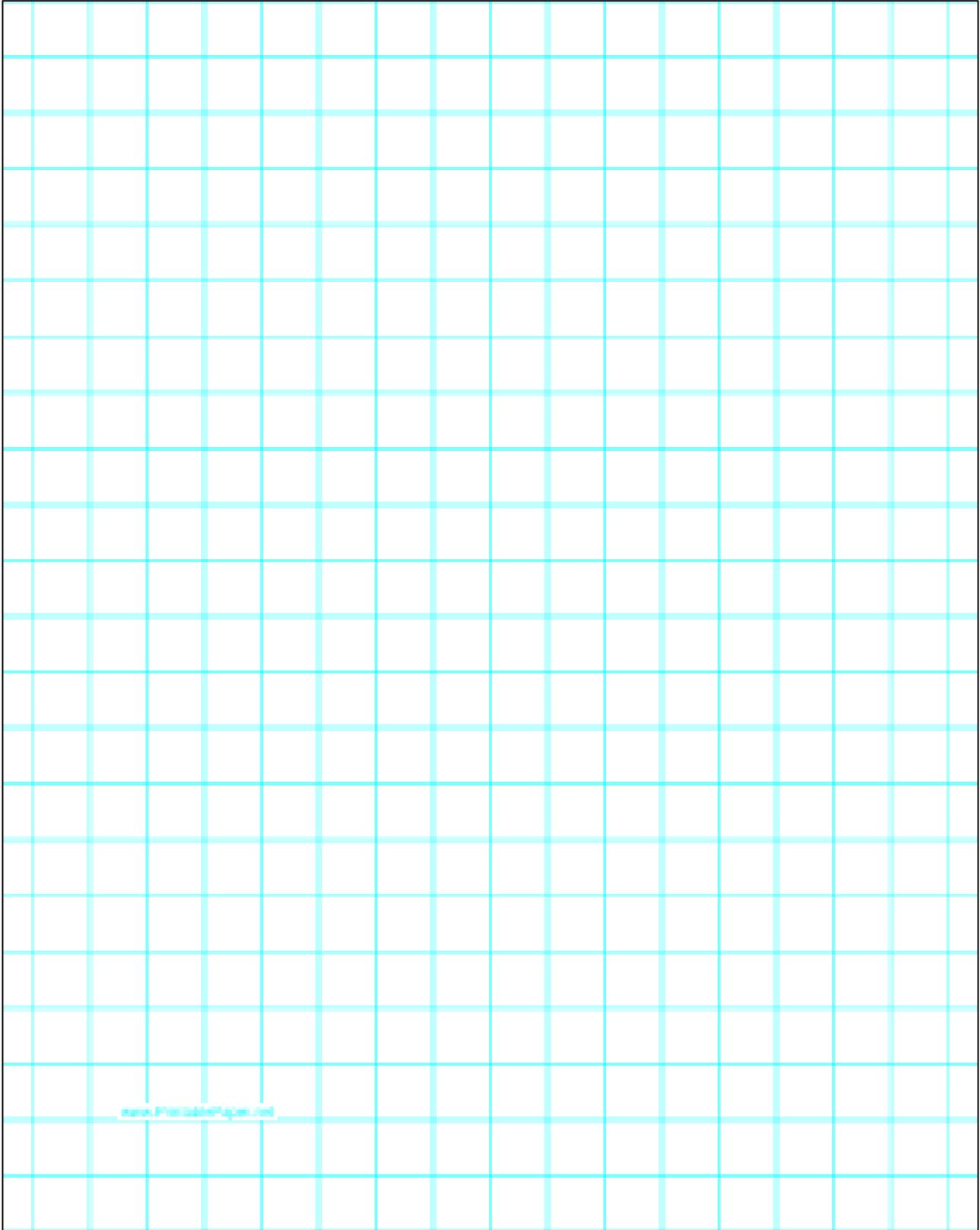
COUNTRY	RANK	TOTAL CO ₂ EMISSIONS	POPULATION 2015	PER CAPITA CO ₂
United States		5433057	320.2M	
Japan		1170715	127.0M	
Indonesia		433989	255.46 M	
Sweden		52515	9.7M	
Nigeria		78910	183.5M	
Iraq		114667	36.0M	
Canada		499137	35.67 M	
Israel		70656	8.29 M	
Norway		57187	5.15 M	
Switzerland		38757	8.2 M	
Poland		317254	38.4 M	
South Africa		460124	54.0M	
Brazil		419754	203.7 M	
Korea D.P.R.		71624	50.4 M	
Egypt		204776	87.85 M	
Colombia		75680	47.95 M	
Saudi Arabia		464481	31.52 M	
Philippines		81591	100.86 M	
Greece		86717	10.9 M	
Bulgaria		44679	7.2 M	
Finland		61844	5.47 M	
Pakistan		161396	182.0 M	
Denmark		46303	5.6 M	
Algeria		123475	39.5 M	
Malaysia		216804	30.4 M	
Ireland		40000	4.6 M	
Serbia		45962	7.1 M	

Student Sheet 4

ANALYSIS/COMPREHENSION

1. What do scientists consider to be the dominant source of greenhouse gas emissions from human activity?
2. What potential do these two activities hold for the future?
3. Why would expect to find countries like China and India high on the list for total CO₂ emissions?
4. Why would they rank very low in per capita emissions?
5. What are the total emissions of CO₂ for 2015?
6. What is the average per capita contribution?
7. What are countries doing in an effort to control greenhouse gas emissions, especially CO₂?
8. Which country has the highest per capita contribution?
9. What does that tell you about living standards in that country?
10. List the 15 top countries in per capita CO₂ emissions from highest to lowest.
11. Which 3 of the top 15 countries would probably be the least comfortable to live in? Why?
12. What sources of CO₂ have not been included in this data?
13. How would the answer to the previous question affect the ranking of countries like Colombia, Brazil and Indonesia?
14. What kinds of things could be done to bring these emission levels down?

Student Sheet 5



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